

A SURVEY OF SIMULIUM (MONTISIMULIUM) IN THE SICHUAN PROVINCE WITH TWO NEW SPECIES (DIPTERA, SIMULIIDAE)

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Abstract The present paper provides the first checklist of the *Simulium* (*Montisimulium*) from Sichuan Province. It is comprised of 9 species which including 2 new species, *S. (M.) jisigauense* sp. nov. and *S. (M.) chuambeinse* sp. nov. The specific names were given by their type locality.

Key words Simuliidae, *Simulium* (*Montisimulium*), checklist, new species, Sichuan Province.

The subgenus *Montisimulium* Robtsov, 1974 of genus *Simulium*, contains several upland species. The *Montisimulium* fauna of Sichuan Province has been poorly studied, only 2 species (Chen *et al.*, 2005) previously described and other two new species are being published. In this paper, the authors report additional two new species collected from the same distribution area. Morphological descriptions and illustrations of those new species, and a checklist of Sichuan members of the Subgenus *Montisimulium* are given. The type specimens are deposited in the Department of Biology, Guiyang Medical University.

1 Checklist of Sichuan's member of the *Simulium* (*Montisimulium*)

Family Simuliidae Newman

Subfamily Simuliidae

Genus *Simulium* Latreille s. str. 1802

Subgenus *Montisimulium* Robtsov, 1974

S. (M.) hailuogouense Chen Huang and Zhang, 2005

S. (M.) chuambeinse sp. nov.

S. (M.) conaustylum Deng, Zhang and Chen, 1995

S. (M.) heishuiense Chen and Wen, sp. nov. (being published)

S. (M.) jiajinshanense Zhang and Chen, sp. nov. (being published)

S. (M.) jisigouense sp. nov.

S. (M.) lingziense Deng, Zhang and Chen, 1995

S. (M.) moxiense Chen, Huang and Zhang, 2005

S. (M.) schizolum Zhang and Chen, 1995

2 Descriptions of two new species

2.1 *Simulium* (*Montisimulium*) *jisigouense* sp. nov. (Figs. 1–15)

Female. Body length about 4.0 mm. Wing length about 3–4 mm.

Head. Narrower than thorax. Frons and clypeus dark brown, with yellowish hairs as well as sparse brown ones. Frons ratio 7.5: 4.9: 6.8; frantal head ratio 7.5:

34.6. Antenna composed of 2 + 9 segments, brown except scape pale. Maxillary palp brownish, with 5 segments, proportional length of 3rd to 5th segments 5.8 : 4.5: 8.9; 3rd somewhat enlarged, sensory vesicle elongate, about 2/3 length of respective segment. Maxilla with 9 inner teeth and 8 strong outer ones. Mandible with 27 inner small teeth and no out ones. Cibarium bare.

Torax. Scutum black, not shiny and covered with yellow pubescence as well as sparse erect black hairs on prescutellar area. Scutellum brown with several erect brown hairs. Postscutellum brown and bare. Pleural membrane and katepisternum bare. Legs. Fore coxa and trochanter yellowish brown, whereas mid and hind ones brown. All femora yellow except distal 1/4 which are brown. All tibiae brown with median large portion yellow. All tarsi brown except hind basitarsus and basal 1/3 of second tarsomere yellow. Fore basitarsus slender, cylindrical, about 10 times as long as wide. Hind basitarsus parallel sided, W:L= 1.0:7.0. Calcipala and pedisulcus well developed. Each claw with sharp basal tooth which is about 1/3 length of claw. Wing. Costa with spines as well as hairs. Subcosta full haired. Basal section of R haired. R with spinules and hairs. Hair tuft on base of costa and stem vein black.

Abdomen. Basal scale brown with a fringe of pale brownish hairs. Dorsal surface of abdomen dark brownish, not shiny. Genitalia. Sternite 8 with about 25 long setae on each side. Anterior gonapophyses tongue shaped, produced posteriorly; inner margin narrowly sclerotized; posterior border rounded. Genital fork with sclerotized lender stem; arms moderately wide, each with a slender, long projection directed forwards, as well as weakly sclerotized triangular one directed inwards. Spermatheca globular in shape. Paraproct of moderate size. Cercus about 2.0 times as long as wide.

Male. Body length about 4.3 mm. Wing length about 3.8 mm.

Head. Width equal to that thorax. Clypeus black

with brown hairs. Upper eye consisting of 14 vertical and 16 horizontal rows of large facets. Antenna brown, 1st flagellomere about 1.8 times of the next in length. Maxillary palp with 5 segments, sensory vesicle almost rounded which is about 0.25 length of 3rd segment.

Thorax. Nearly as in female, except hind basitarsus somewhat inflated, W:L= 1.0: 4.2 and subcosta of wing bare.

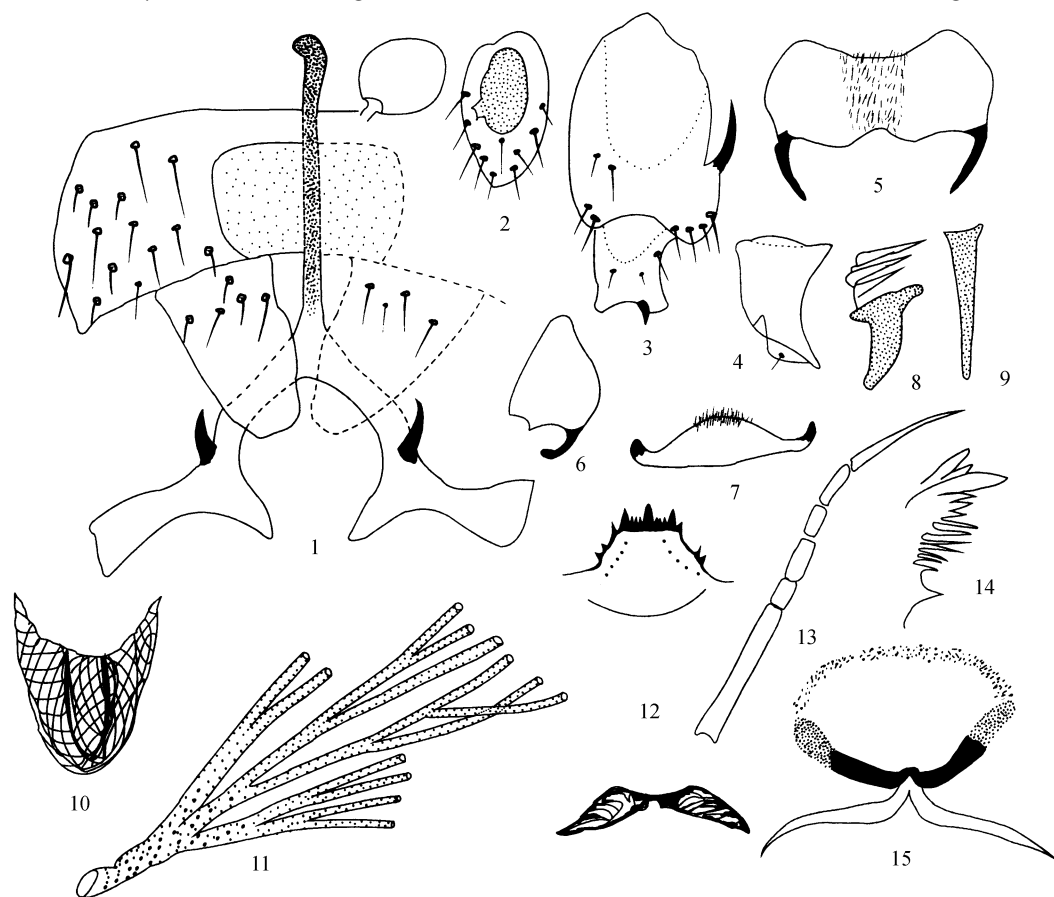
Abdomen. As in female. Genitalia. Coxite subconical, about 1.6 times as long as wide. Style small, about 1/2 length of coxite, with a stout apical spine. When viewed ventrolaterally, style abruptly narrowed apically and twisted inwards. Ventral plate lamellate, much wider than long, ventral and posterior surface setae medially; posterior margin broadly concave, proximal margin concave medially and lateral margin rounded;

basal arms short, strongly sclerotized and slightly curved in inwards. Parameres each with 3 strongly parameral hooks. Median sclerite rod in shape, gradually widened toward tip.

Pupa. Body length about 4.0 mm.

Head and thorax. Integument pale yellow, densely covered with tubercles. Trichomes simple and very minute. Gill organ with 12 filaments approximately 2/3 length of pupal body, arranged in groups of 2, 6, 4 from dorsal to ventral; all filaments tapering distally and with conspicuous tubercles as well as minute ones.

Abdomen. Arrangement of setae, spines and hooks of both dorsal and ventral surfaces of abdomen similar to those of *S. (M.) jingshanense*. Cocoon. Simple, slipper shaped, tightly woven, extending ventrolaterally and without a definite anterior margin.



Figs 1-15. *Simulium (Montisimulium) jingouense* sp. nov.

1. Female genitalia. 2. Female sensory vesicle. 3. Coxite and style of male. 4. Style in lateral view. 5. Ventral plate. 6. Ventral plate in lateral view. 7. Ventral plate in end view. 8. Parameral organ. 9. Median sclerite. 10. Cocoon in dorsal view. 11. Filaments. 12. Larval head capsules in ventral view. 13. Larval antenna. 14. Larval mandible. 15. Larval anal sclerite.

Mature larva. Body length about 7.0 mm. Cephalic apotome with marked head spots. Antenna composed of 4 segments in proportion of 7.8:11.2:7.0:0.3; the 2nd segment with 3 secondary annulations. Cephalic fan with approximately 34 main rays. Mandible with a large and a small madibular tooth but without supernumerary serrations. Hypostomial teeth 9 in number, median and

corner teeth strongly prominent and intermediate ones smallest; 5 hypostomial bristles lying subparallel to lateral margins. Postgenal cleft very minute. Thoracic and abdominal integument bare. Recta gill lobes compound, each with 14-16 finger-like secondary lobules. Anal sclerite of usual x shaped, with subequal arms. Ventral papillae well prominent. Posterior circlet with about 84 rows of

up to 17 hooklets per row.

Holotype ♀, reared from pupa, slide-mounted, was collected from a small, shaded stream from Jisigou, Siguniang Mountain (31°25' N, 103°24' E; 2 700 m), Sichuan Province, China, 28 July 2004, by ZHANG Churr Lin. Paratypes: 1 ♀, 3 ♂ ♂, reared from pupae, 11 pupae and 4 larvae, were taken from trailing grasses and decaying leaves exposed to the sun on the same day as the holotype.

Distribution. Sichuan Province, China.

Remarks This new species seems to fall into the Subgenus *Montisimulium* of the genus *Simulium*. It is characterized by the have 12 pupal filaments arranged in groups 2, 6, 4, the cocoon lacks antero-dorsal projection, and the larval antenna with some secondary annulations. These combined characters are shared by several known *Montisimulium* species, such as *G. (M.) lingziense* Deng *et al.*, and *S. (M.) taishanense* Sun and Li from China.

Although the both adult of *S. (M.) lingziense* is unknown, but differs in some respects, such as the cocoon loosely woven and the anterior margin which is raised medially in the pupa. Whereas the *S. (M.) taishanense* differs in the structure of both genitalia including the shape of anterior gonapophyses and genital fork in the female, and the shape of style, ventral plate and median sclerite in the male.

2.2 *Simulium (Montisimulium) chuanbeense* sp. nov. (Figs. 16-27)

Female. General color dark brownish. Body length 4.0 mm. Wing length about 3.2 mm.

Head. Slightly narrower than thorax. Frons black, covered with golden pubescence intermixed with sparse brown hairs. Clypeus black, covered with several brown hairs. Frontal ratio 8.0:5.1:7.0. Frons:head ratio 8.0:28. Frontal-ocular area well developed. Antenna composed of 2+9 segments, scape, pedicel and base of 1st flagellar segment yellowish brown, rest brown. Maxillary palp with 5 segments, proportional length of 3rd to 5th segments 7.3:5.0:15.8; 3rd segments enlarged, with oblong sensory vesicle, which about 0.5 length of the 3rd segment. Maxilla with 10 inner teeth and 12 outer ones. Mandible with 26 inner teeth and lacking outer ones. Cibarium armed without denticles.

Thorax. Scutum black, covered uniformly with golden pubescence as well as sparse black hairs. Scutellum brownish black with erect black hairs. Postscutellum brown and bare. Pleural membrane and katepisternum smooth. Legs. All coxae and trochanters brown except basal 1/2 of fore trochanters pale. All femora yellow with distal 1/4 brown. All tibiae brown except median large portions of outer surface yellow. All tarsi brown except hind basitarsus and basal 1/2 of second tarsomenes pale. Fore basitarsus slender, cylindrical,

about 9.0 times as long as wide. Hind basitarsus nearly parallel-side, about 8.0 times as long as wide. Calcipara enlarged; pedisulcus moderately deep. Each claw with large basal tooth. Wing. Costa with heavy stout black spinules intermixed with black hairs; subcosta haired entirely; radius haired. Hair tufts on base of costa and stem vein brownish black. Knob of haltere brownish, stem darkened.

Abdomen. Targa brownish black. Marginal hairs yellowish brown. Genitalia. Sternite 8 with about 15 long hairs on each side. Anterior gonapophyses tongue-shaped, membranous; inner margins nearly parallel and lightly sclerotized. Genital fork with sclerotized slender stem; each arm with nearly quadrangular distal expansion and a strongly sclerotized postero-lateral margin but devoid of projection directed forwards. Spermatheca nearly globular in shape. Paraproct of moderate size. Cercus about 2.0 times as long as wide and with round posterior margin.

Male. Body length 4.2 mm. Wing about 3.6 mm.

Head. Width equal to that of thorax. Upper-eye consisting of 14 vertical and 16 horizontal rows of large facets. Clypeus black and covered with sparse brownish black hairs. Antenna composed of 2+9 segments, brown except scape yellow, 1st flagellar segment about 1.7 times the length of the next one. Maxillary palp grayish black, sensory vesicle almost rounded, about 0.22 the length of 3rd segment.

Thorax. Nearly as in female except hind basitarsus slightly inflated, W:L ratio 1.0:4.5 and subcosta of wing bare.

Abdomen. Nearly as in female. Genitalia. Coxite subconical-shaped, being longer than wide. Style small, about 0.7 length of coxite, abruptly narrowed apical and with a stout apical spine, when viewed in ventrolaterally, style with a distinct directed outwards subapical rounded projection which is with several small stout teeth. Ventral plate lamellate, subrectangular in ventral view, with a distal margin concave and proximal margin nearly level; each lateral margin having a directed outwards basal process; ventral and posterior surface setose medially; basal arms about 2/3 length of plate body and converging apically. Parameres each with 5 strongly parameral teeth. Median sclerite slender with bifid tip.

Pupa. Body length about 5.5 mm.

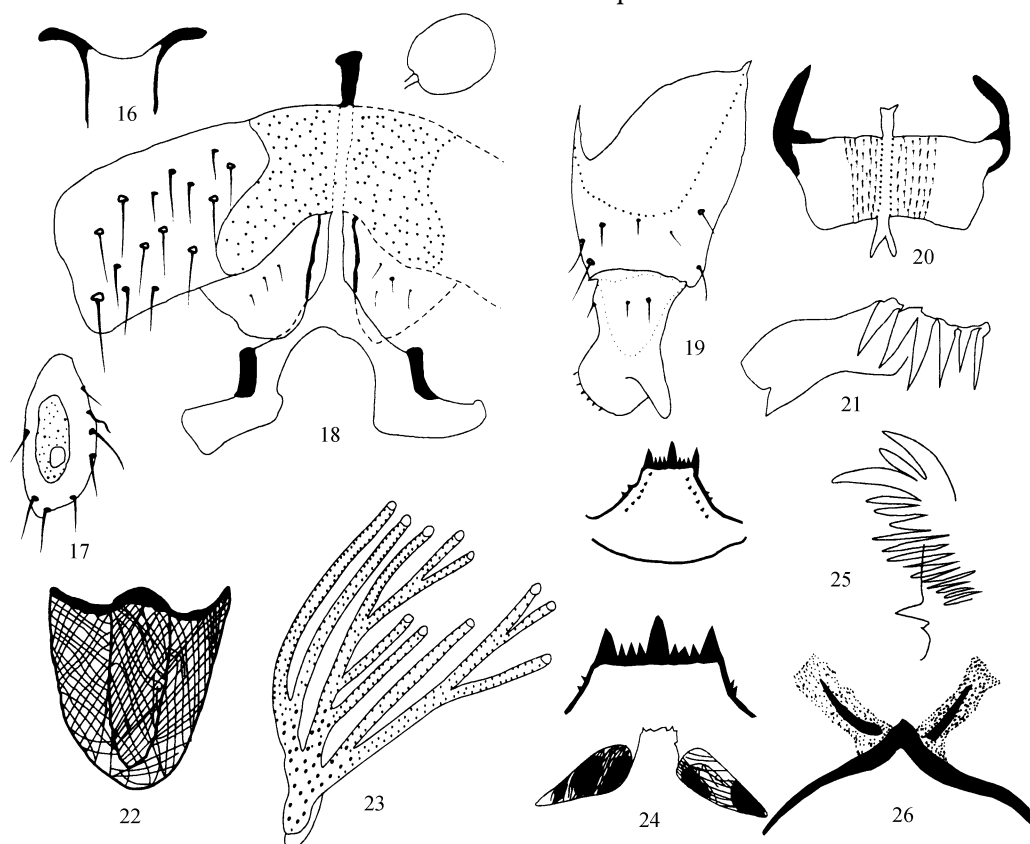
Head and thorax. The integument densely covered with tubercles. Trichomes of head and thorax very minute and simple. Gill organ with 11 or 12 filaments arranged in groups of 2, 5, 4 or 2, 5, 5 from dorsal to ventral; approximately 1/2 length of pupal body, all filaments tapering apical and uniformly covered with conspicuous cone-shape tubercles as well as very minute ones.

Abdomen. Terga 1 and 2 weakly sclerotized and tuberculate. Arrangement of setae, spines and hooks of

both dorsal and ventral surfaces of abdomen same to those of *S. (M.) jigjishanense* except tergum 6 spine combs not so developed. Cocoon. Simple, slipper shaped, tightly woven, with strong anterior margin which is somewhat raised medially but lacking dorsomedian projection.

Mature larva. Body length about 7.5 mm. Cephalic apotome yellowish brown with faint positive head spots. Antenna composed of 4 segments in proportion of 6.0: 7.0: 4.8: 0.3. Head fan with 28-34 main rays. Mandible with a large and a small madibular serration but without

supernumerary serration. Hypostomium with 9 sharply pointed teeth apically; corner and median teeth strongly prominent; 6 or 7 hypostomial setae on each side lying subparallel to lateral margins. Postgenal cleft minute and notch-like, consequently postgenal bridge very large. Thoracic and abdominal integument bare. Rectal gill compound, each lobes with 10-13 finger-like secondary lobules. Anal sclerite xformed, with anterior arms about 3/4 the length of posterior ones. Posterior circler with 82 rows of up to 14 hooklets per row. Ventral papillae well developed.



Figs 16-26. *Simulium (Montisimulium) chuanbasense* sp. nov. 16. Female cibarium. 17. Female sensory vesicle. 18. Female genitalia. 19. Coxite and style of male. 20. Ventral plate and median sclerite of male. 21. Parameral organ. 22. Cocoon in dorsal view. 23. Filaments. 24. Larval head capsules in ventral view. 25. Larval mandible. 26. Larval anal sclerite.

Holotype ♀, reared from pupa, slide-mounted, was collected from a small fast-flowing stream from the Jisigou Siguniangshan (31°25'N, 103°24'E; alt. 2700 m), Sichuan Province, China, 29 July 2004, coll. ZHANG Chur-Lin. Paratypes: 1 ♀, 1 ♂, 5 pupae and 8 larvae, all slide-mounted, were taken from submerged grass blades exposed to sun and same data as holotype.

Distribution. Sichuan Province, China.

Remarks. The present new species seems to fall into the Subgenus *Montisimulium*, as defined by Rubtsov (1974). It is closely allied to *S. (S.) concavustylum*, *S. (M.) schizolomum* and *S. (M.) hailuogouense* from China, and the *S. (M.) stackelbergi*, *S. (M.) odontostylum* from Tajikistan in having 12 pupal filaments

with conspicuous tubercles and arranged in groups of 2, 5, 5 from dorsal to ventral.

The new species, however, can be separated from all the related species mentioned above by several combination characters, such as the features of the genitalia in both sexes, the pupal cocoon without dorsomedian projection but with raised medially and the filaments branching which are usual with 11 filaments arranged in groups 2, 5, 4.

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四川省山蛭亚属分类记要并二新种记述（双翅目，蛭科）

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摘 要 记载四川省蛭属山蛭亚属 *Simulium* (*Montisimulium*) 计 9 种，其中含 2 新种，吉斯沟山蛭 *Simulium* (*Montisimulium*) *jisigouense* sp. nov. 和川北山蛭 *Simulium* (*Montisimulium*) *duanbeiense* sp. nov.，文中对其不同虫期进行形态描述并与其近缘种进行分类讨论并附四川省山蛭亚属名录。

关键词 双翅目，蛭科，蛭属，山蛭亚属，名录，新种。
中图分类号 Q969.442.9